

CETACEAN SPECIES RICHNESS AND RELATIVE ABUNDANCE AROUND
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The Bar Reef Marine Sanctuary, off north-western Sri Lanka, and its adjacent waters were suspected to be an important Cetacean habitat, but a dedicated survey had never been undertaken. Therefore, a one-year survey was carried out from April 2004 to May 2005 to fill the vacuum of knowledge on Cetacean species of the area, and to gather baseline data for management and conservation. Surveys were carried out twice every month. Thirty three sightings of eight cetacean species were documented. The species recorded were *Balaenoptera acutorostrata*, *Balaenoptera musculus*, *Physeter macrocephalus*, *Kogia sima*, *Peponocephala electra*, *Stenella longirostris*, *Tursiops truncatus* and *Sousa chinensis*. The first confirmed sighting of *S. chinensis* in Sri Lanka's waters was recorded while *K. sima* and *P. electra* were sighted off the west coast for the first time. The northern and central parts of the Sanctuary can be termed as 'cetacean hotspots' due to high species richness and year-round abundance. Baseline data from this survey can be used immediately for management purpose, though further research is recommended. *S. chinensis* needs special consideration as the newly discovered population is heavily dependent on the Puttalam Lagoon which is under intense human use, making these dolphins vulnerable to a multiplicity of anthropogenic threats.

Key words: Cetacean, species richness, relative abundance, *Sousa chinensis*, *Kogia sima*, *Peponocephala electra*, Sri Lanka

INTRODUCTION

The Bar Reef Marine Sanctuary (BRMS) is one of the few marine protected areas in the waters off the northern Indian Ocean island of Sri Lanka. This Sanctuary is 306.7 sq. km in area and is located between 8° 16' 00"-8° 32' 00" N and 79° 44' 00"-79° 46' 70" E off the Kalpitiya Peninsula on the north-western coast of Sri Lanka. It was demarcated under the countries Fauna and Flora Protection Ordinance in 1992, and is divided into a buffer zone and core area, within which varying degrees of human activity take place (Rajasuriya *et al.* 1995).

The BRMS and its surrounding waters were suspected to be important for cetaceans on the basis of opportunistic observations and sporadic sightings in the area (Leatherwood *et al.* 1984; Rajasuriya *et al.* 1995; Dayaratne *et al.* 1997; Ilangakoon 2002). Though some information was available for the area, a dedicated cetacean survey had never been carried out in this marine sanctuary or its immediate surroundings. Therefore, the waters within the BRMS, the Puttalam Lagoon immediately adjacent to it, and the deeper waters immediately seaward of it were selected as the study area for the present survey. The water depth within the Puttalam Lagoon varies from 1 to 5 m, while the waters within the BRMS straddle the 20 m contour towards its western boundary. Beyond the Sanctuary's western boundary, the depth increases rapidly, with the 20 m and 100 m contours located in close proximity to each other.

The present survey was undertaken to fill the information lacuna on cetacean fauna in and around BRMS. The survey was designed with the primary objective of gathering data on the species richness and relative abundance of cetaceans occurring in the area. This was deemed necessary in order to make informed management decisions based on scientific data, which would lead to a long-term conservation and rational management of important marine fauna.

METHODOLOGY

Vessel-based cetacean sighting surveys were conducted twice a month from April 2004 to March 2005. One survey was done within the Sanctuary, using a 25-hp outboard engine-powered fibreglass vessel and one offshore survey was done seaward of the Sanctuary boundary using a larger 3.5 ton motorised fishing boat. A pre-planned saw-tooth patterned transect line was covered each month in order to maximise the coverage area in the available time and resources.

Offshore surveys to look for cetaceans beyond the seaward boundary of BRMS were conducted during all months except in June 2004 when the survey had to be abandoned half way through due to adverse weather conditions. The Sanctuary survey was not conducted during May, June and July as the weather was very rough. In all, 21 days were spent at sea actively searching for cetaceans during the one-year survey period.

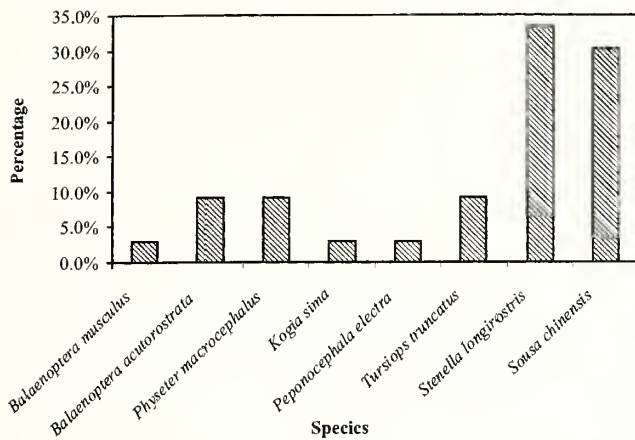


Fig. 1: Relative abundance of Cetaceans (N=33 sightings)

There were three observers on board to look for cetaceans. The observers rotated through three positions – port observer, bow observer and starboard observer – at 30-minute intervals. The port and starboard observers surveyed the area from the beam of the vessel to approximately 10 degree from the bow, while the bow observer surveyed the area directly ahead of the vessel in a 20 degree cone, and also acted as the data recorder. The survey effort was made when the sea state was below Beaufort 4 and visibility was good. When the sea state exceeded Beaufort 4 or heavy rain made visibility poor, the effort was suspended. Cetaceans or cetacean groups encountered were approached to a distance where species identification and group size estimates were possible. A pair of 7x50 binoculars was used to verify the distant sightings and determine species.

The data on cetaceans encountered was recorded on a standard data sheet with particular attention to position at sighting, species identification, group size, presence of calves and general behaviour. Other parameters such as environmental conditions and associated fauna were also recorded. Positions were recorded using a hand-held GARMIN e-trex global positioning system; photographs were taken once the cetaceans were approached.

RESULTS

The survey yielded a total of 33 sightings of eight cetacean species. The eight species of cetaceans included two species from Suborder Mysticeti, Family Balaenopteridae, namely Blue Whale *Balaenoptera musculus* and Minke Whale *Balaenoptera acutorostrata*. The other six species belonged to Suborder Odontoceti and included the Sperm Whale *Physeter macrocephalus* of Family Physeteridae, Dwarf Sperm Whale *Kogia sima* of Family Kogiidae, and Melon-headed Whale *Peponocephala electra*, Indo-Pacific Humpback Dolphin *Sousa chinensis*, Long-snouted Spinner Dolphin *Stenella longirostris* and Common Bottlenose Dolphin *Tursiops truncatus* all of Family Delphinidae.

Cetaceans were sighted in all months except June, when the survey was abandoned midway due to bad weather (Table 1). Species richness was high in February, April, August, and September. Approximately 50% of the sightings were within the BRMS (Fig. 2). Species richness was high within the Sanctuary, with six of the eight species sighted at least once. Most sightings were clustered around the western, seaward boundary of the northern and central parts of the

Table 1: Number of Cetacean sightings by month and species in and around the Bar Reef Marine Sanctuary

Month	<i>B. mus</i>	<i>B. acu</i>	<i>P. mac</i>	<i>K. sim</i>	<i>P. ele</i>	<i>T. tru</i>	<i>S. lon</i>	<i>S. chi</i>	Total
April	-	1	-	-	-	2	-	3	6
May	-	-	-	1	-	-	-	-	1
June	-	-	-	-	-	-	-	-	0
July	-	-	-	-	-	-	-	1	1
August	1	1	1	-	-	-	-	1	4
September	-	-	2	-	-	-	1	2	5
October	-	-	-	-	-	-	2	-	2
November	-	-	-	-	-	1	3	-	4
December	-	1	-	-	-	-	2	-	3
January	-	-	-	-	-	-	1	-	1
February	-	-	-	-	1	-	2	2	5
March	-	-	-	-	-	-	-	1	1

Note: Complete species names in column headings of the above Table

B. mus = *Balaenoptera musculus*, *B. acu* = *Balaenoptera acutorostrata*, *P. mac* = *Physeter macrocephalus*, *K. sim* = *Kogia sima*, *P. ele* = *Peponocephala electra*, *T. tru* = *Tursiops truncatus*, *S. lon* = *Stenella longirostris*, *S. chi* = *Sousa chinensis*

BRMS, with no sightings towards the southern boundary.

The most common cetacean encountered was Long-snouted Spinner Dolphin *Stenella longirostris* (33.3%) (Fig. 1). It also had the widest distribution and was recorded throughout the central part of the BRMS and in deeper waters seaward of the Sanctuary boundary. This species was also sighted in very large schools during February, April, August, and September, with some groups containing over 1,000 animals, including many juveniles. Sighting of the Indo-Pacific Humpback Dolphin *Sousa chinensis* (30.0%) was restricted to the Puttalam Lagoon and the north-western extremity of the Sanctuary (Fig. 2). These are the first scientifically documented sightings of this species in Sri Lankan waters.

Minke Whale *Balaenoptera acutorostrata*, Sperm Whale *Physeter macrocephalus* and Common Bottlenose Dolphin *Tursiops truncatus* accounted for 9.0% each of the total recorded sightings. Minke Whale sightings were clustered in a small area within the north-central part of the BRMS (Fig. 2). Common Bottlenose Dolphin were sighted from north to south along the seaward (western) boundary of the Sanctuary, and Sperm Whale sightings were limited to deep offshore areas beyond the seaward boundary of the Sanctuary (Fig. 2).

Blue Whale, Dwarf-Sperm Whale, and Melon-headed Whale were recorded only once (3.0%) each. While Dwarf-Sperm Whale and Melon-headed Whale were sighted in deep waters, the Blue Whale sighting was within the BRMS where water depth ranges from shallow to moderate (Fig. 2).

DISCUSSION

Twenty-seven cetacean species have been recorded from Sri Lanka's waters to-date (Ilankakoon 2002). The eight species recorded in this survey account for about 30% of all the species. It is noteworthy that a survey carried out over a short period of one year, with 21 field days, recorded almost 30% of all species in the Sri Lankan waters within this small survey area off the north-west coast.

The Long-snouted Spinner Dolphin was the most common species of cetacean in this area. This agrees with the other surveys conducted off Sri Lanka's west, south and east coasts in the 1980s and 1990s (Leatherwood *et al.* 1984; Alling 1986; Leatherwood and Reeves 1989; Ilankakoon *et al.* 2000; Ilankakoon 2002). However, the very large schools sighted during February, April, August, and September, often in association with the Yellow-fin Tuna *Thunnus albacares*, during the present survey have not been reported before. While this dolphin species has been documented in Tuna-Dolphin associations in other parts of the world, such as the

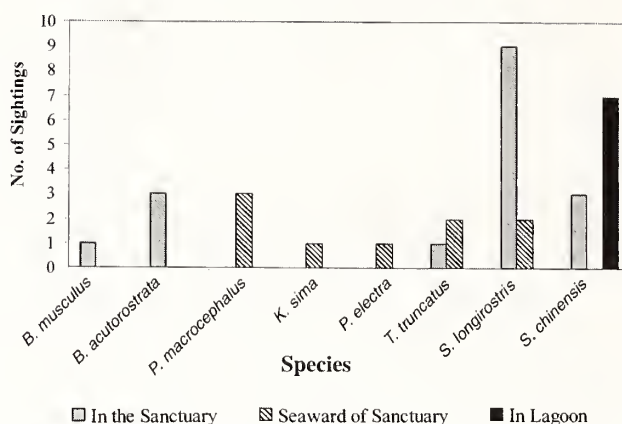


Fig. 2: Distribution of cetacean species in relation to sighting area

Eastern Tropical Pacific, the association with the Yellow-fin Tuna in northern Indian Ocean has not been extensively documented (Ilankakoon 2002). While Ilankakoon (2000) mentions that some sightings during a 1994 study on the west coast indicated an association between these two species, the present survey shows a very strong association in which the occurrence of large schools of this dolphin coincides with the Tuna fishing season during September-October. Tuna fishermen in the BRMS study area were aware of this and actually looked for dolphins to find the Tuna. Despite containing many juveniles, these dolphin schools interacted freely with the tuna fishing boats and our survey vessel, bow-riding often and showing no fear.

Although the Indo-Pacific Humpback Dolphin accounted for 30% sighting during the present survey, the occurrence of this species has never before been documented in any part of Sri Lanka's waters. Although the species was known to be present around the west coast, based on two museum specimens collected in the 1880s and 1934 respectively (Blanford 1891; Deraniyagala 1945; Ilankakoon 2002) and a possible unconfirmed sighting from an aerial survey for dugongs in the early 1980s around Dutch Bay in the Puttalam Lagoon (Leatherwood *et al.* 1984), there have been no confirmed sightings of the Indo-Pacific Humpback Dolphin till the present survey. It is possible that the species is common only off the north-west coast of Sri Lanka including the shallow Puttalam Lagoon, and was never properly documented due to the lack of dedicated previous cetacean surveys in the area. This is substantiated by the fact that the skull collected in 1891 was from the Gulf of Mannar off north-west Sri Lanka and the unconfirmed sighting in the 1980s was also in the Puttalam Lagoon.

The Minke Whale accounted for 9% of the sightings in the present survey, but this species has not been commonly sighted during the surveys of other parts of Sri Lanka. Leatherwood *et al.* (1984) reported a single sighting off the

east coast, and Ilangakoon (2002) reported one sighting off the west coast and another off the north-west coast near Thalawila, just south of the present study area. Accordingly, the present results in conjunction with the previous observation by Ilangakoon (2002) indicate that the waters in and around the BRMS may be an important habitat for this species in Sri Lanka.

The Sperm Whale and the Common Bottlenose Dolphin also accounted for 9% each of the total number of sightings recorded in the present study. Several studies and surveys off Sri Lanka have reported that the Sperm Whales are common in deeper waters all around the islands and this has been particularly well-documented off the east coast (Alling *et al.* 1982; Whitehead *et al.* 1983; Leatherwood *et al.* 1984; Ilangakoon 2002). While Ilangakoon (2002) reported previous sightings off the north-west coast, more recently the Ocean Alliance research vessel *R/V Odyssey* reported large numbers in the deeper waters of the Gulf of Mannar off north-western Sri Lanka (Ocean Alliance 2003). The Common Bottlenose Dolphin was not as numerous or common in the present study area as has been reported for other areas off Sri Lanka. The species has been reported as being commonly sighted off the east coast (Alling 1986) and off the south and west coasts (Ilangakoon *et al.* 2000; Ilangakoon 2002). The present data is not sufficient to offer an explanation for the Common Bottlenose Dolphin being less common in the study area, but sightings along the seaward boundary of the BRMS, where there is a change in water depth, indicate that this may be a preferred feeding area for the species.

The Blue Whale, Dwarf-Sperm Whale and Melon-headed Whale were not commonly seen but were recorded only once each during this survey. However, the Blue Whale is common around Sri Lanka, especially off the east, south and west coasts (Ilangakoon 2002). It is of interest to note that the Blue Whale sighting during the present survey was within the BRMS in moderately shallow waters and not in the deeper waters beyond as would be expected. However, as stated by Ilangakoon (2002), the species has previously been sighted in near-shore continental shelf waters in other areas off the west coast of Sri Lanka. Both the Dwarf-Sperm Whale and the Melon-headed Whale are not commonly sighted species anywhere in Sri Lanka's waters, but have been frequently recorded in the fisheries by catch around the island (Leatherwood and Reeves 1989; Ilangakoon 1997, 2000; Ilangakoon *et al.* 2000). While there have been no previous sightings of either species off the west coast of the island, Alling (1986) reported a single sighting of the Dwarf-Sperm Whale from the east coast. A possible, but unconfirmed, sighting of the Melon-headed Whale was also previously

reported from the north-east coast (Leatherwood *et al.* 1984). During the present survey both these species were encountered in deeper offshore waters beyond the BRMS, and sightings of both species were recorded off the west coast for the very first time.

To conclude, the survey succeeded in filling the lacunae on information on cetacean species richness and relative abundance in this area and added new knowledge on the distribution of the cetaceans in Sri Lanka's waters as a whole by documenting one species never sighted previously and two others that had not been sighted off the west coast of the island. While the entire study area off north-western Sri Lanka has a rich cetacean diversity, it is suggested that the area from the northern boundary of the BRMS to its central section be considered a 'cetacean hotspot' due to the high species richness and numerous sightings made throughout the year. This should also be taken into consideration while planning future conservation and management strategies for the BRMS, and ideally the core area should be extended in order to provide better protection to these cetaceans. The role of the Puttalam Lagoon in providing an essential habitat to the newly discovered population of the Indo-Pacific Humpback Dolphin should be investigated. Since this population was only discovered through the present survey, more detailed studies are needed to ensure its long-term survival through management measures based on sound scientific data. This is urgent and extremely important because the Puttalam Lagoon is under intensive human use posing a multiplicity of anthropogenic threats to these dolphins. Finally, it should be noted that the data from this survey have only provided a baseline upon which further studies could be undertaken on the cetacean fauna of the area. While these baseline data can be used immediately for management purposes more detailed studies are recommended as the area appears to provide a habitat for globally threatened species, such as Blue Whale and Sperm Whale.

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